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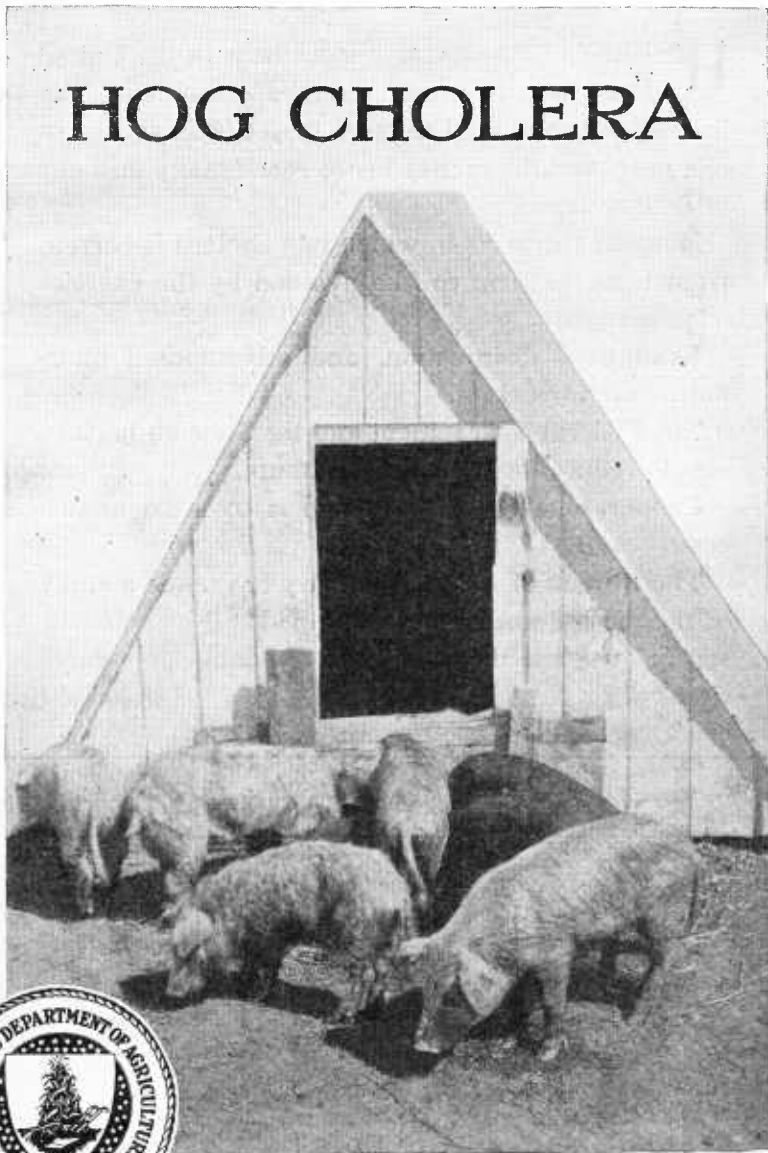
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FARMERS' BULLETIN No. 834

HOG CHOLERA



HOG CHOLERA destroys more hogs in the United States than all other diseases combined. The losses have amounted to more than 6,000,000 hogs in one year, and the money losses reach many millions of dollars yearly.

Many of the ways in which hog cholera is carried from farm to farm can be avoided by the exercise of proper care.

Sanitation, disinfection, and self-imposed quarantine are important.

The Federal Government and the State authorities aim to reduce losses to the minimum.

Cooperation by all concerned is essential to success.

The Bureau of Animal Industry has made a study of the disease and finally developed anti-hog-cholera serum, which is the only known reliable preventive agent.

HOG CHOLERA: PREVENTION AND TREATMENT.¹

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PREVALENCE.

HOG CHOLERA, the most serious disease of hogs, is found in practically all parts of the world. In this country it appeared first in 1833 in Ohio, and later spread to every State in the Union. It is most prevalent in the States of the Middle West and of the South, where hogs are raised in greatest numbers. The Pacific Coast States remained practically free from hog cholera until recent years, probably because of the limited production of hogs and their limited importation from the infected districts of the country.

In the South, where the winters are mild and the temperatures more or less uniform, severe outbreaks of hog cholera may occur at any season of the year, but statistics collected from experiments conducted in 14 States, principally in the Middle West, show that the disease reaches its greatest height during October and November. After this time it dies down rapidly, particularly after snow falls, and reaches its lowest point during February.

LOSSES FROM HOG CHOLERA.

While hog cholera has been present in this country continually for more than 50 years, it has been unusually prevalent in certain periods.

¹The original edition of this bulletin, issued in August, 1917, was written by M. Dorset and O. B. Hess. This revised edition has been prepared by M. Dorset and U. G. Houck.

The first period of exceptional prevalence reached its climax in 1887, the second in 1897, and the third apparently reached its height in 1913 and 1914. During these periods the hog-raising industry over the entire country suffered great losses and in some localities was for a time practically destroyed.

TABLE 1.—*Estimated number of hogs in each State on January 1, and losses from cholera, 1918–1925.*

State.	1925		1924		1923		1922	
	Hogs on hand.	Losses from cholera.	Hogs on hand.	Losses from cholera.	Hogs on hand.	Losses from cholera.	Hogs on hand.	Losses from cholera.
Iowa.....	8,958,000	322,488	10,539,000	521,657	9,615,000	566,900	7,546,000	536,521
Illinois.....	4,438,000	166,963	5,368,000	257,664	4,693,000	187,720	4,046,000	284,029
Missouri.....	3,481,000	125,316	4,463,000	235,646	4,306,000	189,464	3,693,000	199,422
Nebraska.....	4,545,000	181,800	5,223,000	334,372	4,232,000	216,678	3,680,000	195,408
Indiana.....	3,143,000	118,177	3,880,000	198,656	4,102,000	213,304	3,567,000	250,403
Ohio.....	2,462,000	63,027	3,077,000	120,618	3,091,000	118,694	2,862,000	133,941
Kansas.....	2,146,000	37,770	2,980,000	90,592	2,776,000	71,066	2,113,000	66,559
Minnesota.....	3,116,000	87,248	3,800,000	139,840	2,610,000	108,576	2,330,000	98,559
Texas.....	1,542,000	22,205	1,904,000	44,173	2,326,000	55,824	2,475,000	191,149
South Dakota.....	2,727,000	100,354	3,029,000	177,317	2,283,000	105,931	1,900,000	128,250
Georgia.....	1,485,000	62,964	1,542,000	80,184	2,152,000	111,904	2,131,000	115,074
Wisconsin.....	1,294,000	22,774	1,673,000	32,122	1,725,000	37,260	1,659,000	40,313
Tennessee.....	1,071,000	23,990	1,373,000	38,444	1,654,000	50,282	1,546,000	55,656
Oklahoma.....	841,000	18,166	1,121,000	31,388	1,401,000	33,624	1,334,000	36,018
Kentucky.....	859,000	17,180	1,109,000	32,826	1,311,000	31,464	1,214,000	38,241
Alabama.....	893,000	21,432	1,089,000	38,333	1,281,000	36,893	1,307,000	58,815
North Carolina.....	1,000,000	44,000	1,159,000	44,506	1,271,000	44,739	1,258,000	45,288
Mississippi.....	850,000	20,400	1,063,000	37,408	1,207,000	33,796	1,219,000	32,913
Pennsylvania.....	994,000	15,904	1,212,000	21,331	1,200,000	28,800	1,143,000	30,861
Michigan.....	932,000	16,403	1,165,000	23,300	1,135,000	40,860	1,051,000	26,485
Arkansas.....	847,000	27,104	952,000	38,080	1,114,000	48,125	1,255,000	84,712
South Carolina.....	484,000	15,488	569,000	15,932	947,000	34,092	938,000	42,210
California.....	709,000	17,016	834,000	26,688	876,000	17,520	834,000	22,518
Virginia.....	576,000	11,981	655,000	18,340	792,000	17,107	805,000	23,184
Louisiana.....	565,000	18,080	665,000	31,920	756,000	51,408	756,000	51,030
Florida.....	570,000	36,480	633,000	48,128	703,000	28,120	725,000	35,888
New York.....	446,000	5,352	557,000	9,358	546,000	10,483	520,000	11,706
Colorado.....	466,000	6,710	622,000	9,947	523,000	9,623	455,000	12,285
North Dakota.....	586,000	11,720	651,000	16,145	478,000	11,089	435,000	9,004
West Virginia.....	261,000	4,176	316,000	6,220	316,000	6,320	293,000	6,593
Maryland.....	254,000	8,128	299,000	11,417	299,000	9,089	285,000	10,260
Idaho.....	340,000	6,800	378,000	6,048	235,000	3,706	196,000	3,528
Oregon.....	209,000	1,505	220,000	1,760	231,000	2,587	233,000	2,934
Washington.....	201,000	2,412	239,000	2,103	217,000	3,472	212,000	3,816
Montana.....	292,000	3,504	270,000	3,888	198,000	2,692	180,000	3,078
New Jersey.....	113,000	1,989	133,000	2,660	132,000	3,168	132,000	3,208
Utah.....	97,000	1,242	121,000	1,549	108,000	1,728	90,000	1,863
New Mexico.....	60,000	720	71,000	682	89,000	854	94,000	1,269
Wyoming.....	119,000	1,523	119,000	1,904	84,000	1,075	73,000	986
Massachusetts.....	55,000	880	75,000	1,200	72,000	1,440	76,000	2,052
Maine.....	63,000	655	76,000	1,520	68,000	1,088	69,000	1,055
Vermont.....	50,000	560	62,000	892	59,000	1,180	58,000	1,409
Arizona.....	48,000	384	57,000	319	57,000	684	53,000	2,395
Connecticut.....	35,000	224	44,000	667	45,000	1,008	47,000	1,058
Delaware.....	40,000	800	44,000	1,760	43,000	1,720	41,000	1,800
New Hampshire.....	28,000	224	31,000	421	28,000	582	30,000	577
Nevada.....	25,000	600	28,000	448	25,000	800	25,000	450
Rhode Island.....	8,000	128	11,000	106	12,000	240	12,000	281
United States.....	54,234,000	1,674,746	65,501,000	2,772,002	63,424,000	2,564,837	56,996,000	2,774,033

TABLE 1.—*Estimated number of hogs in each State on January 1, and losses from cholera, 1918–1925—Continued.*

State.	1921		1920		1919		1918	
	Hogs on hand.	Losses from cholera.	Hogs on hand.	Losses from cholera.	Hogs on hand.	Losses from cholera.	Hogs on hand.	Losses from cholera.
Iowa.....	9,510,000	385,155	10,389,000	561,006	10,925,000	443,462	10,307,000	389,605
Illinois.....	4,585,000	206,325	5,323,000	301,814	5,724,000	206,064	5,111,000	174,797
Missouri.....	4,047,000	134,757	4,305,000	162,729	4,943,000	195,742	4,708,000	177,963
Nebraska.....	3,063,000	121,295	3,366,000	106,029	4,250,000	137,700	4,200,000	151,200
Indiana.....	4,209,000	189,405	4,760,000	257,040	4,668,000	168,048	4,168,000	174,307
Ohio.....	3,921,000	148,214	4,351,000	195,795	4,266,000	115,182	3,774,000	118,881
Kansas.....	1,810,000	57,015	1,667,000	30,006	2,381,000	55,715	2,560,000	57,600
Minnesota.....	2,803,000	80,726	2,951,000	106,236	2,784,000	73,168	2,241,000	50,423
Texas.....	2,427,000	58,976	2,356,000	74,214	2,320,000	66,816	3,068,000	74,553
South Dakota.....	1,525,000	68,625	1,730,000	93,420	1,654,000	37,215	1,504,000	39,255
Georgia.....	3,102,000	233,344	3,165,000	199,395	3,043,000	172,538	2,766,000	161,811
Wisconsin.....	2,236,000	50,310	2,236,000	66,409	2,181,000	39,258	2,019,000	39,977
Tennessee.....	1,636,000	58,896	1,946,000	89,321	1,965,000	79,582	1,634,000	80,883
Oklahoma.....	836,000	26,334	943,000	33,948	1,036,000	28,904	1,219,000	38,399
Kentucky.....	1,429,000	38,583	1,681,000	68,080	1,768,000	68,421	1,716,000	61,776
Alabama.....	1,861,000	92,120	2,201,000	118,854	2,223,000	118,041	2,128,000	91,930
North Carolina.....	1,528,000	78,386	1,592,000	67,341	1,546,000	69,570	1,464,000	72,468
Mississippi.....	1,783,000	75,421	2,369,000	140,166	2,282,000	92,421	1,902,000	111,267
Pennsylvania.....	1,339,000	24,102	1,420,000	38,340	1,420,000	37,062	1,291,000	34,857
Michigan.....	1,435,000	32,289	1,450,000	32,625	1,355,000	20,731	1,372,000	29,636
Arkansas.....	1,459,000	98,483	1,586,000	128,466	1,725,000	139,725	1,643,000	133,083
South Carolina.....	1,528,000	78,386	1,088,000	53,856	1,056,000	46,569	966,000	39,993
California.....	930,000	25,110	973,000	26,271	1,003,000	16,248	974,000	26,298
Virginia.....	1,026,000	36,936	1,127,000	40,572	1,134,000	35,721	1,105,000	39,780
Louisiana.....	1,250,000	92,250	1,512,000	122,472	1,599,000	136,145	1,568,000	127,008
Florida.....	1,493,000	120,933	1,588,000	142,920	1,512,000	115,668	1,375,000	111,375
New York.....	781,000	14,058	920,000	20,700	814,000	18,315	842,000	15,914
Colorado.....	325,000	7,313	382,000	6,876	406,000	7,308	356,000	10,574
North Dakota.....	402,000	7,236	428,000	9,630	456,000	9,028	708,000	7,301
West Virginia.....	425,000	7,650	443,000	8,771	439,000	11,062	422,000	8,356
Maryland.....	427,000	15,372	461,000	27,798	434,000	12,108	388,000	13,170
Idaho.....	163,000	1,760	187,000	1,851	205,000	2,059	219,000	2,760
Oregon.....	272,000	1,714	314,000	3,391	348,000	3,758	309,000	4,728
Washington.....	267,000	3,364	292,000	4,204	317,000	5,706	283,000	3,566
Montana.....	200,000	2,160	160,000	3,024	200,000	2,700	174,000	3,483
New Jersey.....	182,000	4,095	210,000	11,907	120,000	8,088	174,000	4,698
Utah.....	103,000	2,317	114,000	2,154	123,000	1,992	102,000	1,653
New Mexico.....	85,000	1,913	83,000	1,045	93,000	1,674	86,000	1,394
Wyoming.....	57,000	513	63,000	850	63,000	567	54,000	438
Massachusetts.....	130,000	2,106	176,000	3,326	130,000	2,381	113,000	2,136
Maine.....	97,000	3,083	116,000	1,879	110,000	1,881	100,000	1,530
Vermont.....	105,000	2,079	120,000	3,456	106,000	2,025	120,000	2,916
Arizona.....	40,000	720	50,000	1,350	58,000	1,044	64,000	1,160
Connecticut.....	78,000	1,053	100,000	1,710	83,000	1,419	64,000	1,210
Delaware.....	68,000	3,060	73,000	4,007	71,000	2,619	64,000	2,304
New Hampshire.....	57,000	718	67,000	964	66,000	831	56,000	706
Nevada.....	30,000	540	32,000	576	40,000	826	37,000	400
Rhode Island.....	13,000	199	16,000	320	14,000	315	16,000	216
United States.....	66,649,000	2,648,440	72,909,000	3,377,032	75,587,000	2,815,004	71,374,000	2,701,825

At times the value of hogs destroyed by cholera in the United States has amounted to about \$65,000,000 in a single year, and the average annual loss for a period of 40 years probably was not less than \$30,000,000. This represents merely the direct losses; if the indirect losses could be computed, these figures would be greatly increased. Table 1 gives the estimated production of hogs and losses from cholera by States for the years 1918 to 1925, inclusive.

The losses from hog cholera in the United States during the last 32 years are shown in Figure 1.

THE CAUSE OF HOG CHOLERA.

Hog cholera is a highly contagious disease of swine, caused by a germ or microorganism which is present in the blood, urine, feces, and secretions of the eye and nose. It is accompanied with fever, has a high death rate, and, so far as known, does not affect other animals or man. All breeds of hogs are alike naturally susceptible to the disease, but there is a considerable difference in the degree of susceptibility possessed by different individuals. It has been asserted by some that mule-foot hogs are immune, but experiments have proved that they are as susceptible as other breeds and the disease is quite as fatal to them.

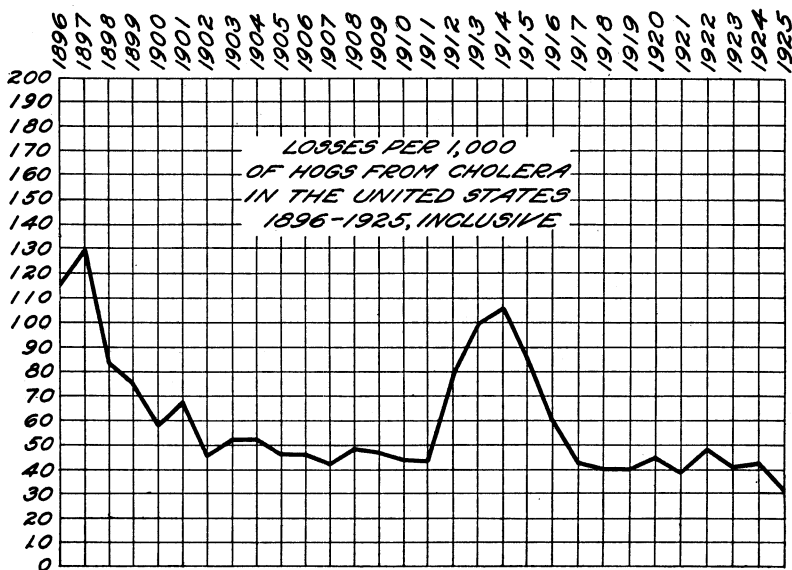


FIG. 1.—Showing losses from hog cholera in the United States from 1896 to 1925, inclusive.

The germ that causes the disease has never been cultivated artificially in laboratories, as many other infectious germs have. It can not be seen, even with the most powerful microscope; it passes readily through the pores of the finest filters, which will hold back all visible bacteria; and it is known only by the effects which it produces. In these respects it resembles the germs that cause foot-and-mouth disease and rinderpest in cattle. Although insanitary surroundings and improper feeding tend to lower vitality and thus perhaps render animals less able to withstand the disease, such conditions can not of themselves cause hog cholera. It can be produced only by the specific microorganism of hog cholera.

SYMPTOMS SHOWN BY HOGS SICK WITH CHOLERA.

The symptoms of hog cholera differ in different hogs and in different herds, depending upon the strength of the germs and the ability of the animals to withstand the disease. As a result of these variations the disease has been said to exist in two forms—acute and chronic. In the acute or severe type hogs sicken and die quickly, so that farmers will say that a hog found dead in the morning was well the night before. In the chronic or less severe type, hogs may be sick for weeks or months before they succumb.

When cholera first appears in a herd the hogs do not all become sick at once, but, on the contrary, only one or two will refuse to come up to feed with the herd. They will remain hidden in the nest and when driven from the bed their backs may be arched and they may appear cold and shiver. The rest of the herd may remain apparently well for several days, when others are likely to be found affected in about the same way as those first attacked. As the disease progresses the sick hogs become gaunt or tucked up in the flank, and have a weak, staggering gait, the weakness being most marked in the hind legs.

If the lungs are affected there may be a cough, which is particularly noticeable when the hogs are disturbed. The eyes usually are inflamed and show a whitish discharge, which may cause the lids to stick together.

Constipation, which is commonly present in the early days of the disease, is generally followed by a diarrhea. As the disease reaches its height red or purplish blotches are likely to appear upon the skin of the ears, of the belly, and of the inner surfaces of the legs.

Some of the symptoms mentioned may be present in other diseases, but the owner should remember that cholera spreads rapidly through a herd and no time should be lost in calling a veterinarian to diagnose the disease and administer the proper treatment. If the disease is cholera, heavy losses can be averted only by prompt administration of antihog-cholera serum.

The temperature of the hogs is of much importance in diagnosing cholera. The normal temperature in ordinary weather, when the hogs are not excited or worried, will range from 101° to 104° F., but when cholera is present it is not uncommon to find a large proportion of the hogs with temperatures from 104° to 107°, and even higher.

APPEARANCE OF A HOG AFTER DEATH FROM CHOLERA.

An examination of carcasses of hogs that die assists in determining whether they have died of cholera. In making an examination after death first examine the skin for purple blotches resembling a

birthmark. Then the carcass should be placed on its back and opened in the same manner as when butchering for market, care being taken to avoid cutting the internal organs.

Lungs.—In acute cholera the surfaces of the lungs frequently show small red spots varying in size from a pinhead to a small pea. These spots can not be washed off, and when found are an important indication of cholera. It is not unusual, instead of finding the lungs soft, filled with air, and pinkish in color, as is the case in a normal condition, to find them solid and of a grayish or dark-red color, which results from a form of pneumonia. This condition, however, is not so characteristic of hog cholera as the reddish spots mentioned.

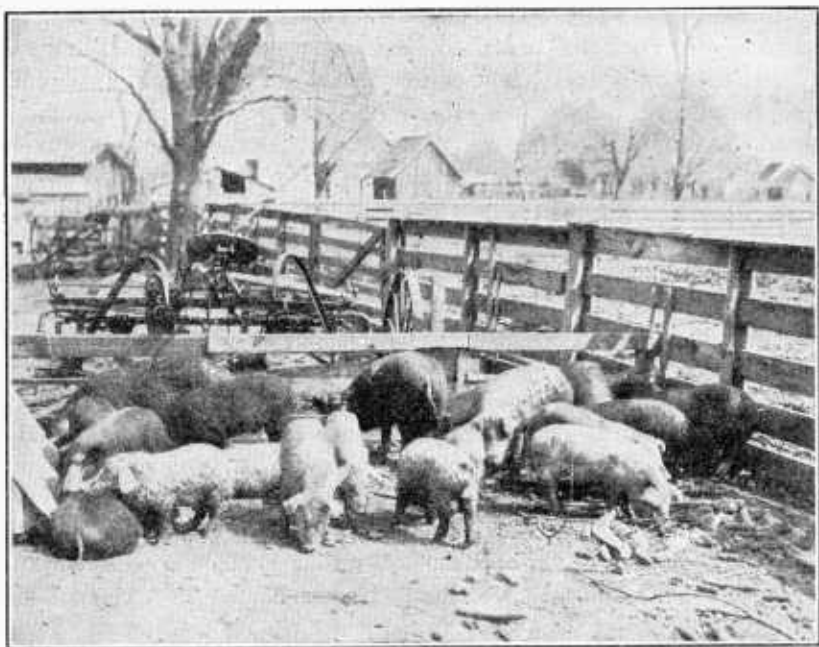


FIG. 2.—A herd of swine sick with hog cholera.

Heart.—When removed from the membranous sac surrounding it the surface of the heart may show blotches or blood spots such as those on the lungs. These, however, are seen only rarely and then usually in the acute or severe form of hog cholera.

Liver.—The liver generally shows changes, but it varies in appearance even under normal conditions, and therefore does not show changes that can be regarded as characteristic of cholera.

Spleen, or melt.—In acute cases of hog cholera the spleen, or melt, is often large, dark, and soft. In chronic cases, however, it may be smaller than normal and grayish in color.

Kidneys.—The kidneys when removed are found surrounded by a thin, fibrous tissue. This should be peeled off carefully to avoid injury to the surface of the kidney and an examination made for dark-red spots varying in size from mere points to areas as large as the head of a pin. The spots may be few, or the surface of the kidney may be as speckled as a turkey's egg. These spots on the kidneys are very commonly present in acute cases of hog cholera. (Fig. 3.)

Bladder.—The inner surface of the bladder under normal conditions is white or a faint pinkish white in color, but in well-marked cases of hog cholera it may show bright-red specks which can not be washed off. In cases of long standing there may be ulcers.

Stomach.—In some cases of hog cholera, when the stomach is opened and washed out, red spots and ulcerations may be found on the inner surface.

Small intestines.—In some acute and virulent types of hog cholera the outer surface of the small intestines may have the appearance of being spattered with blood. The bloody spots, however, can not be removed by washing. The inner lining may be congested, inflamed, greatly thickened, and covered with a yellowish coating; or it may be dotted with small blood spots like those seen on the outer surface.

Large intestines.—The large intestines may show, over the outer surface, the same characteristic blood spots as are seen at times on the small intestines. The inner surface in acute cases of hog cholera also may show small blood-stained areas, and in addition to this the feces found in this portion of the bowel may be streaked with blood.

In chronic cases, where the hog has been sick for some time, there are usually found on the inner surface of the large intestines round, hard areas called "button ulcers." (Fig. 4.) These ulcers are raised above the surrounding tissue and usually are yellowish in color, while the larger ones may have a dark center. The ulcers vary in size from one-sixteenth of an inch to 1 inch in diameter and are not found in any other disease of swine.

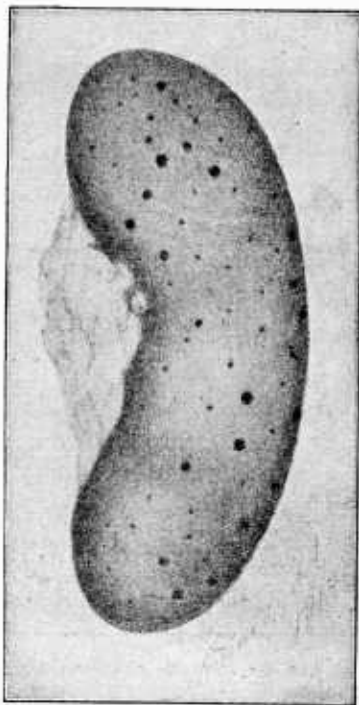


FIG. 3.—Hog's kidney, showing blood spots caused by cholera.

Lymphatic glands.—The changes which take place in the lymphatic glands as a result of hog cholera frequently are striking. The most important glands to be examined are found in the fat just under the skin of the belly, in the region of the flanks. In health these glands are of a rather light-grayish color; in cases of cholera they may be enlarged and red, and in severe cases they may appear almost black. If cut through with a knife, it will be found generally that the outer portion or rind of the gland is affected to the greatest extent. Other lymphatic glands which undergo similar changes are found in the

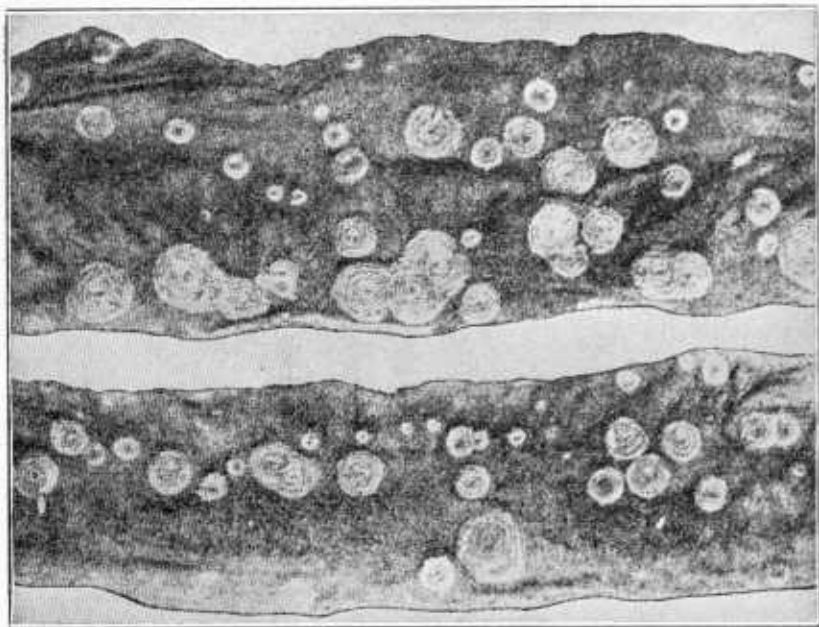


FIG. 4.—Intestine of cholera hog, showing ulcers. (After Hutyra and Marek.)

fatty tissues at the angle of the lower jaw and in the thin membrane which holds the intestines together.

Bones.—The bones are congested, as may be seen by cutting through the breast bone.

SUMMARY OF POST-MORTEM APPEARANCE.

Briefly, the important changes found in the carcass after death from hog cholera are as follows:

1. Purple blotches on the skin.
2. Blood-colored spots on the surfaces of the lungs and heart, on the kidneys, and on both the outer surface and inner surfaces of the intestines, stomach, and bladder.
3. Reddening of the lymphatic glands.
4. Enlargement of the spleen in acute cases.
5. Ulceration of the inner surface of the large intestine.

Any one or all of these changes may be found in a hog which has died from hog cholera, but it is rare to find all in any one case. In the lingering or chronic cases of hog cholera it is usual to find the intestinal buttonlike ulcers, while the blood-colored spots described are, as a rule, found only in the acute cases.

DISEASES WHICH MAY BE MISTAKEN FOR HOG CHOLERA.

The diseases of swine most likely to be mistaken for hog cholera are swine plague, pneumonia, tuberculosis, anthrax, necrobacillosis, and lung and bowel disturbance due to worms.

Swine plague or pig pneumonia.—It is not practicable for farmers to attempt to distinguish between hog cholera and swine plague, for they are so much alike that many skilled veterinarians find it almost impossible to distinguish one from the other. Inasmuch as swine plague is rarely found to exist as a separate disease and usually exists merely as a complication of hog cholera, it is advisable for a farmer to treat suspected swine plague just as he would a case of cholera.

Tuberculosis.—In tuberculosis the onset is slow; in cholera it is sudden and more violent. Hogs rarely die quickly of tuberculosis, while fatal cases of cholera usually succumb within two weeks. In an outbreak of cholera, as a rule, only a small proportion of the swine on the premises show symptoms of the disease in the beginning and it spreads gradually through the herd. It is possible for a whole herd to show signs of tuberculosis at about the same time if they contract the disease from the same source, as, for instance, from drinking unpasteurized skim milk from public creameries or from following cattle infected with tuberculosis.

The changes in the internal organs of a tuberculous hog which attract most attention consist of abnormal growths on the pleura covering the ribs and whitish or grayish spots or lumps of varying sizes on the surface of the lungs, liver, or spleen, or on all of these organs. When cut into with a knife these areas are found to be fibrous, cheesy, or gritty. Tuberculosis frequently affects the lymphatic glands, but the changes here can hardly be mistaken for the lesions of cholera, for, unlike cholera, tuberculosis causes the glands to break down, forming yellow, cheesy, or semiliquid masses. In the advanced stage of the disease these masses usually contain small, hard, gritty particles which to the touch feel like grains of sand. In tuberculosis the kidneys do not show the small dark spots that are observed in cholera.

Anthrax.—Hogs rarely are affected with anthrax, but when this disease does occur it may readily be mistaken for the acute type of hog cholera. One of the distinguishing features of anthrax in hogs

is the marked swelling of the throat and tongue, with frequently a blood-stained, frothy discharge from the mouth. Anthrax in hogs usually follows the disease in other animals on the farm, as cattle, sheep, and horses, which are more susceptible than hogs.

Necrobacillosis.—This disease may appear in various forms. Sores may appear on the feet, udder, and gums. One form of this disease, where there is enlargement of the nose, is commonly called “sniffles” or “bullnose.” Another common form is called necrotic enteritis. In the latter condition there is usually a lack of appetite, and while diarrhea is not constant, it is seen frequently in the early stage of this disease. The pigs become unthrifty, emaciated, and weak. The lesions of this form of the disease most commonly affect the inner lining of the large intestines, but in advanced cases the lining of the small intestines also is involved. Small, white, well-defined areas may be seen through the outer covering of the large intestines, and on splitting open the intestine the inner lining is found thickened, with white, dead patches ready to slough off, but they do not form the buttonlike ulcers as in chronic cholera. In advanced cases patches of the inner lining of the intestine can be scraped away with the thumb nail. Under these conditions the animal rapidly wastes away and dies from lack of nutrition. The absence of red spots on the belly, the lack of fever, the slow development of the disease in the herd, and the fact that it is confined principally to pigs and shoters, all serve to distinguish this disease from cholera.

Worms.—Growing pigs often suffer from infestation with worms, both in the lungs and in the intestines, but old hogs rarely show the effect of such infestation. The most important symptom produced by worms is general unthriftiness.

The worms that infest the lungs are very small, usually one-half to 1 inch in length, and they bring about an inflammation of the air passages which causes coughing and may result in pneumonia. They can be found by a careful examination of the frothy discharge from the mouth of sick pigs or in the fluid obtained by squeezing the freshly cut surfaces of the lungs after death. In this disease there is an absence of symptoms of acute sickness, unless pneumonia develops.

The worms that infest the intestines vary in size, some attaining a length of 10 inches. These parasites impair the general health of the pigs and by irritation of the alimentary tract may cause diarrhea.

While a large proportion of the pigs and shoters in a herd may become affected with worms and act in somewhat the same way as those attacked by hog cholera, the facts that there is no fever and that the ailment does not affect grown hogs are of material assistance in distinguishing this trouble from hog cholera.

It is advisable to secure the services of a competent veterinarian immediately when disease appears in the herd in order to avoid mistakes in diagnosing the malady and to save time in applying the proper treatment.

MODES OF INFECTION WITH HOG CHOLERA.

Hog cholera does not occur in a herd except through the introduction of the specific germ of that disease. So far as known, the germs of hog cholera develop and propagate only in the bodies of hogs. There is no more certain way of introducing hog cholera than by placing in the herd a hog already infected with the disease. A sick hog, then, must be regarded as the most dangerous agent in the spread of cholera. Hogs affected with cholera discharge the germs of the disease from their bodies in the urine, the feces, and the secretions of the nose and eyes. Therefore the manure, bedding, litter of all sorts, and the dirt in pens where sick hogs are kept are contaminated with the germs of the disease. These germs may enter the hog's system by means of food or drink and probably also through wounds or abrasions of the skin.

The shipment to market of hogs affected with cholera has resulted in the infection of public stockyards, unloading chutes, and railroad cars used for hauling hogs. Consequently if healthy hogs are shipped in ordinary stock cars, or if they are unloaded in public stockyards or through public chutes, they are likely to become infected with cholera. Any agency which will serve to carry infected litter, manure, or material of any sort from public stockyards or cars to farms may result in an outbreak of cholera on the farm. Such infected material may adhere to the feet of horses or other stock, to wagon wheels, or to the shoes of men who have entered these public places.

What is true of public stockyards and stock cars is true of farms where cholera exists, and it may be expected that the disease will be carried from an infected farm to healthy herds if preventive measures are not taken. Streams passing through infected farms may carry the germs to other farms. If the carcasses of dead animals have not been disposed of promptly and properly, dogs may carry portions to neighboring farms. At certain seasons it is common for farmers to exchange labor and farm implements, when threshing, shelling corn, filling silos, and delivering grain or stock to market. Unless proper precautions are taken, these practices may serve to spread cholera. It has been said that cholera has been traced in some instances to the visits of stock buyers and venders of stock remedies who go from farm to farm.

If hogs on a clean farm are not kept in lots properly fenced, they may range to contaminated streams or to adjoining herds and thus contract and spread cholera. It is undoubtedly true that infection in many cases results from the purchase of new stock, and at times from the borrowing and lending of stock for breeding purposes. There are records of many herds having become infected from the purchase of stock at public sales on farms where the disease existed. A number of outbreaks have been reported to be due to failure to take proper precautions when taking animals to be bred on premises where sires were kept for public service. It has been common for cholera to appear in herds fed on garbage. These outbreaks were no doubt due in many instances to infection contained in scraps of uncooked pork.

Farms on which hog cholera has occurred may remain infected for a considerable time, and a second outbreak may occur as a result of this harbored infection.

KEEPING CHOLERA OFF THE FARM BY SANITATION.

From what has been said it will be seen that hog cholera may be spread in many ways, and that by proper foresight and the exercise of all possible care on the part of hog raisers the sources of danger may be reduced greatly if not entirely eliminated. With the object of assisting the farmer to protect himself, the following suggestions are offered:

Hog houses, lots, and pastures should be located away from streams and public highways, and the houses and lots should be arranged so that they may be readily cleaned and disinfected. They should be exposed so far as possible to sunlight, which is the cheapest and one of the best disinfectants. Hog lots should not be used for yarding wagons and farm implements and should not be entered with teams and wagons, particularly when returning from stockyards and public highways. Strangers should be excluded from hog lots unless there is reasonable assurance that they do not carry infection. Farmers and their help should disinfect² their shoes and change their outer clothing before entering hog lots after returning from public stockyards, sales, and neighboring farms where infection is known to exist.

Mud wallows and cesspools should be drained, filled, or fenced in. If a wallow is to be used, it should be made of concrete and so designed as to be drained and cleaned easily.

² Compound cresol solution (U. S. P.), or a suitable substitute therefor, is a satisfactory disinfectant for use against hog cholera. The substitute for compound solution of cresol (see B. A. I. Order 245, p. 5) is called "saponified cresol solution." Both products contain 50 per cent of cresol. They are used in 3 per cent solution. This solution is made by adding 4 fluid ounces of the concentrated disinfectant to 1 gallon of soft water.

Runs underneath buildings which can not be readily cleaned and disinfected should be closed. Straw stacks that have been used as nesting places by sick hogs should be burned or removed to a field and plowed under. It is a dangerous practice to leave remnants of stacks accessible to hogs from year to year, and new tenants should beware of this source of danger.

Hogs that do not recover fully from cholera should be destroyed, as they remain a constant danger.

All animals that die on the farm, as well as the entrails removed from animals at butchering time, should be properly disposed of by burning or burying. Unless disposed of in this way they will attract

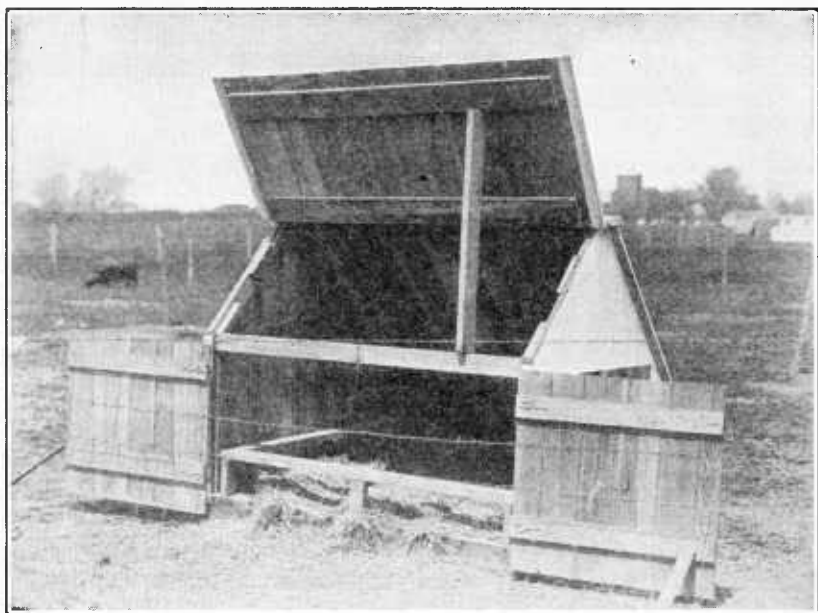


FIG. 5.—A sanitary individual hog house.

dogs or predatory animals that may bring or carry away the germs of hog cholera.

Newly purchased stock, stock borrowed or lent for breeding purposes, and stock exhibited at public fairs should be placed in isolated pens and kept there for at least 15 days before being turned in with the herd. During the quarantine those who feed and care for the new stock should use care to prevent carrying possible infection from these pens to other swine on the premises.

If hog cholera appears on a farm the owner should voluntarily post a notice at the entrance to the premises reading "HOG CHOLERA—KEEP OUT," and all neighbors should be warned so

that they may protect their herds. The infected herd should be confined to limited quarters that can be cleaned frequently during the presence of the disease and sprayed with a disinfectant consisting of 1 part of compound cresol solution to 30 parts of water or with a recognized substitute.

PREVENTION BY INOCULATION.

Antihog-cholera serum.—This serum is prepared from the blood of hogs that have been hyperimmunized against hog cholera. Hogs that are immune against this disease, either naturally, as a result of exposure to infection, or as a result of inoculation, are injected with large quantities of blood from hogs sick with cholera. The blood from sick hogs, even in minute quantities, will kill susceptible pigs but does not injure immunes; on the contrary, it causes immunes to become more highly immune. After the immunes are injected with virulent blood they are called "hyperimmunes." About 10 days or 2 weeks after an immune hog has been hyperimmunized its blood contains a large amount of protective substance composed of antibodies, and it is from such blood that antihog-cholera serum is prepared. At present there are two kinds of serum on the market. One is commonly called "bloody serum," because it is red and cloudy like blood. The other is called "clear serum." This clear serum is merely the bloody serum from which the red-blood cells have been removed. Either form should be effective in protecting hogs from cholera if properly administered in sufficient doses.

The fact that a serum, made in the manner described, will protect hogs from cholera was first brought to the attention of the authorities in the various States by the Bureau of Animal Industry in 1908-9. Following this, several State institutions began the preparation and distribution of the serum, and subsequently its manufacture was taken up by private concerns. The efficacy of the serum is now recognized generally in the United States and in foreign countries.

While the serum is regarded as most efficacious when administered as a preventive, it seems to have some curative value, provided it is administered when hogs are in the very early stages of the disease. But very little benefit can be expected from the treatment of hogs that are visibly sick.

Beginning in 1913 the Bureau of Animal Industry conducted experiments in 17 counties in 15 different States to determine the possibility of reducing losses from hog cholera by a systematic campaign embracing limited quarantine, sanitary measures, and the use of the preventive-serum treatment. In the course of these experiments 234,136 hogs were treated in infected herds, with a loss of 13.1 per

cent, notwithstanding the fact that 85,547, or 36.5 per cent of the number showed high temperatures at the time of treatment.

During the same period 19,208 hogs were treated in uninfected herds for protection, with a total loss from all causes of only 49 hogs, or one-fifth of 1 per cent. The few deaths reported probably were due to causes other than cholera.

Hog-cholera virus.—This virus is prepared from the blood of pigs that are sick with hog cholera. Their blood is defibrinated and mixed with a preservative to make whole-blood virus. A so-called "clear virus" is made by removing the red blood cells from the defibrinated blood before adding the preservative. Both forms of virus contain the live germs of the disease.

METHOD OF ADMINISTERING SERUM.

Two systems are used in protecting hogs from cholera by inoculation—the "serum-alone inoculation" and the "simultaneous inoculation."

Before beginning the treatment of an infected herd the sick and the apparently well hogs should be separated and each lot confined in a pen or inclosure that may be cleaned and disinfected. A catch pen, large enough to hold 8 or 10 pigs, should be made by placing a short gate across one corner of the inclosure nearest the operator. This will prevent worrying or exciting the whole herd. Otherwise the animals may run about and crowd together, thus causing an elevation of temperature that may be misleading, especially in warm weather. It is advisable to withhold feed from all hogs in the herd for at least 12 hours before treatment, but they should be given all the water they will drink.

An ample supply of hot water and clean pails should be on hand for preparing disinfectants and for use in keeping the instruments and the operator's hands clean.

The clean syringes and needles should be sterilized by boiling for 5 or 10 minutes before they are used in treating a herd. A table or bench, covered with clean towels, should be provided for the syringes and other instruments, and there should be a bucket containing a disinfectant³ for rinsing the hands of the operator.

The serum may be poured into a small glass bowl or jelly jar previously cleaned and sterilized by boiling. This should be kept covered with a clean metal or glass lid when not in use. A large tube passed through the cork and reaching to the bottom of the serum bottle, one end being made to fit the syringe the same as the needle, does away with the need for a bowl and provides a more sanitary method of filling the syringe.

³ See footnote on p. 14.

The needle should be removed from the syringe after each injection and placed in a small, shallow receptacle containing a disinfectant, the syringe being filled with serum before a clean needle is put in place. If the nozzle of the syringe becomes soiled, it should be washed thoroughly with a disinfectant before further use. Cleanliness will reduce the possibility of abscesses and blood poisoning.

Sufficient help should be provided to hold the hogs in proper position for treatment. Large hogs that are too heavy to handle in any other way may be snared by the upper jaw and held in this way. In such cases the injection is made in the fold of loose skin in the front of the shoulder back of the ear. Hogs of ordinary size may be handled conveniently in a V-shaped trough or on a small platform

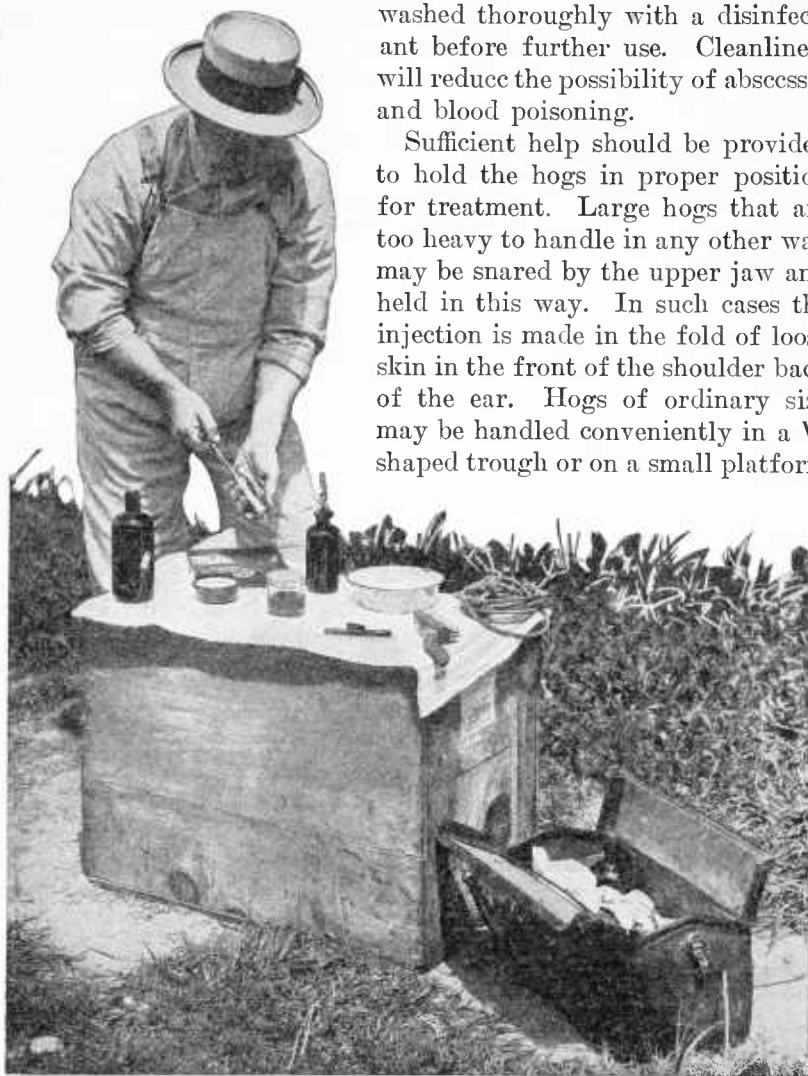


FIG. 6.—Veterinarian getting equipment ready for treating herd.

elevated to a convenient height from the floor. This places the hog in a desirable position for making the injection between the foreleg and the body, which is regarded by many as the best location. Small pigs and shotes up to 75 or 80 pounds may be held up by the hind legs with the forefeet resting on the ground, and the injection made

beneath the skin into the loose tissues of the flank. This is the most convenient way of handling a small pig, as it may be held by one man and is in a suitable position for taking the temperatures, cleansing the areas of operation, and making the injections. Injection into the ham should be avoided, particularly in grown hogs that are to be placed on the market before they have time to recover fully from the injection, as abscesses may develop and remain undiscovered until the ham is cooked and cut for use.

The temperatures of all hogs should be taken and recorded immediately before they are treated. Those showing high temperatures, that is, above 104° F., should be marked, if treated, so that they may be identified, as the treatment of animals with such high temperatures does not promise very satisfactory results. Serum should be used with the understanding that it is a preventive rather than a curative agent. Hogs may be marked conveniently by placing a ring in the upper border of one ear. Hogs that are in an advanced stage of the disease should be destroyed, as they disseminate the infection and rarely make a good recovery.

It is an injustice to the operator, to the owner of the herd, and to the serum producer to administer serum to hogs without at the same time taking and recording the temperatures. It is not uncommon

to find a herd which appears to be perfectly healthy, although at the time a large percentage of the animals may have a high fever. If such herds are treated without knowledge of this condition, the owner may be led to condemn unjustly the serum or the man who applied it, for some losses are likely to occur, particularly if the operator is not warned beforehand, by the temperatures, of the need for large doses of serum. On the other hand, if the temperatures are taken, the operator knows whether to give an ordinary dose of serum for a healthy hog or the larger dose which is essential for those showing evidences of cholera, and he also is able to decide whether it is wise to give the simultaneous inoculation.

Before administering serum or virus the skin covering the point of injection should be cleaned thoroughly and washed with a dis-



FIG. 7.—Injection between foreleg and body (axillary space).

infectant. The needle is then inserted through the skin for a distance of about 1 inch. The injection is made slowly and the needle withdrawn very gradually. Not more than 10 c. c. of serum in the case of small pigs, nor more than 20 to 30 c. c. in the case of larger animals, should be injected in one place, and when virus also is used

it should be injected on the opposite side of the body or at least some distance from the serum.

CARE OF HOGS AFTER TREATMENT.

It is important that hogs should receive proper care after the treatment is administered.

The grain ration should be restricted to not more than two-thirds of the usual quantity for two weeks after simultaneous treatment. It is not advisable to feed corn during this time. Shorts, middlings, bran, ground or soaked oats, crushed rye, barley, kafir, tankage, skim milk, and buttermilk are suitable feeds that may be used in formulating a proper



FIG. 8.—Flank injection.

diet. When possible the animals should be allowed to graze and exercise in a clean pasture in which there are no running streams or mud wallows. A plentiful supply of clean drinking water should be accessible constantly. The sleeping quarters should be kept clean, dry, and well bedded.

If it is necessary to keep the animals confined, their pens should be light, airy, dry, and kept clean and well bedded. The feed troughs should be kept clean, preferably by scalding and scrubbing with hot water.

At the end of two weeks, if the animals are doing well, their diet may include some corn and be gradually increased to full feed.

SERUM-ALONE INOCULATION.

The serum-alone inoculation consists merely in injecting the serum which is obtained from hyperimmunized hogs. The serum may be used either to immunize healthy hogs or to treat those that are in the early stages of the disease. Good serum, properly administered, is incapable of causing hog cholera, as it does not contain the germs of the disease.

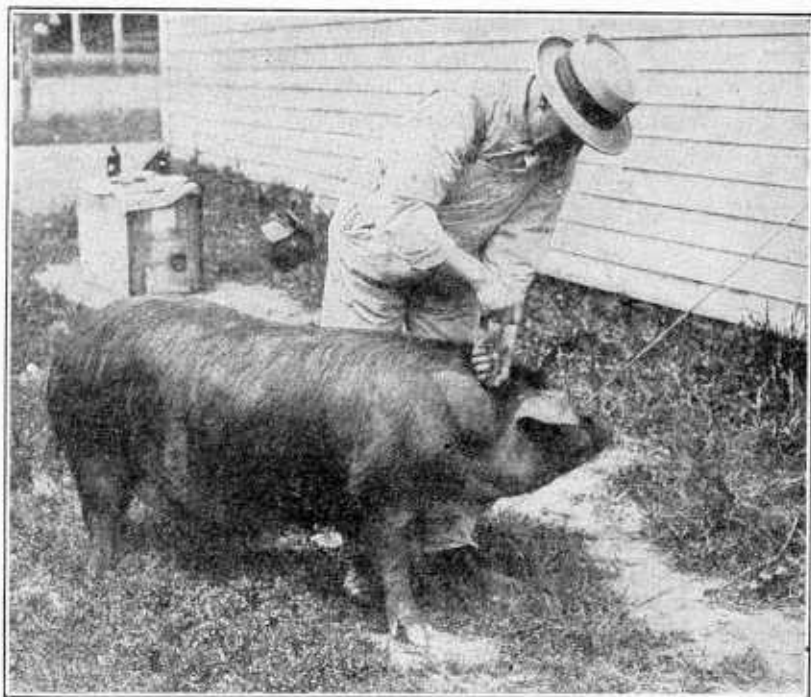


FIG. 9.—Injection back of ear.

Unfortunately serum alone does not produce a permanent immunity against hog cholera. The length of protection which follows the injection of serum alone seems to depend to a certain extent upon the peculiarities of individual hogs, which can not be determined beforehand, and also to some extent upon the dose of serum. Certain experiments have indicated that the immunity lasts somewhat longer in hogs which receive exceptionally large doses. Ordinarily a farmer may count upon the immunity lasting two to six weeks following the treatment of healthy hogs with serum alone, but in some cases it lasts for two or three months. At times, when healthy hogs are treated with serum alone and shortly thereafter

exposed to cholera, they seem to acquire a permanent immunity, but this is not always the case. Serum alone can not be depended upon to produce a lasting immunity even though the treated pigs are promptly exposed to cholera.

It has been stated that serum alone has some value in treating sick hogs. This is true within certain limitations. Ordinarily it is efficacious only in the very early stage of the disease, before the hog shows visible signs of sickness.

DOSAGE OF SERUM ALONE.

The quantity of serum required for producing immunity is influenced by a number of conditions, chief among these being the condition and susceptibility of the pigs and the potency of the serum used. No hard and fast rule can be laid down, but as a general guide the doses in the following table are suggested:

TABLE 2.—Doses for serum-alone inoculation.

Weight of animal.	Dose of serum (cubic centimeters).
Sucking pigs ¹	20
Pigs 20 to 40 pounds.....	30
Pigs 40 to 90 pounds.....	35
Pigs 90 to 120 pounds.....	45
Hogs 120 to 150 pounds.....	55
Hogs 150 to 180 pounds.....	65
Hogs 180 pounds and over.....	75

¹ The dose of serum for very young sucklings may be less than that given in the table, but in no case should less than 10 cubic centimeters be given.

If the herd is infected, the dose of serum should be increased slightly for all apparently well hogs, and all hogs showing high temperatures or other evidence of disease should receive at least a dose and a half of serum.

From what has been said, it will be seen that serum alone may be used under the following conditions:

1. For the treatment of hogs in the very early stages of the disease, as shown by the presence of fever rather than by visible symptoms.
2. For the treatment of hogs which need to be protected for only a short time, as for example, a herd which is to be sent to market within three or four weeks, or in the case of hogs which are to be shipped by rail and thus perhaps exposed to infection while in transit.
3. In the case of very young pigs, when the administration of the simultaneous inoculation is objected to by the owner. In such a case, however, it is advisable to administer the simultaneous treatment within three or four weeks or give successive injections of serum every three or four weeks.

SIMULTANEOUS INOCULATION.

In the simultaneous method of inoculation hog-cholera virus is used in addition to the serum. The theory of the simultaneous inoculation is to administer the virus and at the same time give a dose of serum which will protect the hogs from cholera. The virus enters the system of the hog and causes a reaction which results in establishing an immunity similar to that which is produced in hogs that recover from a natural attack of the disease. The serum generally prevents death or serious sickness which would otherwise be caused by the virus, and through the combined action of these two agents the hogs acquire immunity against cholera. There are many cases on record where the immunity has lasted several years.

DOSAGE OF SERUM AND VIRUS.

The virus, of course, is given in very small doses as compared with the serum. The doses of virus and serum for simultaneous inoculation are indicated in the following table:

TABLE 3.—*Doses of serum and virus in simultaneous inoculation of healthy hogs.*

Weight of animal.	Minimum dose of serum (cubic centimeters.)	Minimum dose of virus.
Sucking pigs ¹	20	Pigs weighing 100 pounds or less, 1 cubic centimeter.
Pigs 20 to 40 pounds.....	30	
Pigs 40 to 90 pounds.....	35	
Pigs 90 to 120 pounds.....	45	
Hogs 120 to 150 pounds.....	55	Hogs weighing more than 100 pounds, 2 cubic centimeters.
Hogs 150 to 180 pounds.....	65	
Hogs 180 pounds and over.....	75	

¹ In simultaneous inoculation of very young sucklings the doses of both serum and virus may be reduced below that given in this table, but the minimum doses should probably never be less than 10 cubic centimeters of serum and $\frac{1}{2}$ cubic centimeter of virus.

If the herd is infected the dose of serum should be slightly increased for all apparently healthy hogs, and all those showing high temperatures or other evidence of disease should receive at least a dose and a half of serum.

While the serum alone has the advantage of being harmless, it should be remembered that it has the disadvantage of producing only a transitory immunity. The conditions are precisely reversed in the case of the simultaneous inoculation. In this case the immunity is prolonged, and it is rare to find a hog, immunized properly by the simultaneous method, which has again become susceptible to cholera.

The principal objection to the simultaneous inoculation is the element of danger caused by the injection of the virus of cholera. If the serum should not be of proper potency or a sufficient dose is not

administered or if the work is not done properly, hog cholera may be produced. Sufficient work, however, has been done to show that the simultaneous inoculation can be administered with safety. Certain important things, however, are to be remembered in this connection. Use good serum and give plenty of serum and virus. Enough serum should be given to prevent any signs of sickness in the treated hogs. To get a lasting immunity it is not necessary to render the hogs visibly sick from the injection. Apparently just as firm immunity is secured when hogs show no symptoms of illness as when they are made sick by the injection. This treatment should be handled carefully, and those who have studied the question agree that the simultaneous inoculation should be administered only by competent veterinarians or by skilled laymen who have had adequate training in its use.

The prolonged immunity caused by the simultaneous inoculation is much to be desired for several reasons. It prevents the recurrence of cholera in the treated hogs; it eliminates the additional expense of retreatment; and it affords a better opportunity to eliminate the germs of the disease from infected premises, thus removing a source of danger from the neighborhood.

It is of the greatest importance when applying the simultaneous inoculation to give an ample dose of serum. In no case will harm be done by increasing the dose prescribed on the bottle labels. It is much better to give a little more serum and save the treated pigs at an added cost of a few cents than to lose them through failure to give serum enough. In general the dose of serum required in the simultaneous inoculation may be said to depend upon the age, weight, and condition of the animal, but the amount of serum required is not in direct proportion to the weight, for small pigs and shoters require a larger dose in proportion to their weight than older animals, and in all classes of hogs which show high temperatures a larger dose of serum should be given than when healthy hogs are being treated. No pig should receive less than 10 cubic centimeters of the ordinary commercial serum, and 80 cubic centimeters may be regarded as a sufficient dose for a healthy hog weighing 200 pounds or more.

The syringe used for injecting the virus should be in perfect order, so that the amount of virus prescribed in the dose table is actually injected into and retained by each animal. If the virus should not be virulent, the effect of the treatment would be the same as if serum alone were administered.

TREATMENT OF HERDS.

Healthy herds.—No definite rule can be laid down as to the necessity for treating healthy herds or as to the method to be used in treating them. In general it can be said that the necessity for the

treatment of healthy herds depends upon surrounding conditions; that is, the proximity of cholera and the ability of the farmer to protect his herd from the infection. It has been demonstrated that susceptible hogs may be kept within a few feet of cholera hogs without becoming infected if sufficient care is taken to prevent the infection from being carried from the sick to the healthy animals. On the other hand, it has been noticed in practice that at times herds on farms immediately adjoining outbreaks of cholera may escape the disease, while farms several miles away become infected. It is probable that the ways in which cholera spreads are not yet fully understood, but it is known that there are certain channels through which it frequently is carried from farm to farm, and cholera is produced only by conveying the infection in some way from sick hogs or infected premises to susceptible hogs.

Notwithstanding the fact that at times herds on farms adjoining an outbreak of cholera may escape the disease, it seems to be good practice for farmers to protect their herds by inoculation when cholera exists in the immediate neighborhood. This is particularly true where the infected herd is not kept under strict quarantine and where the quarters of the sick pigs are not cleaned and disinfected regularly. The serum-alone treatment might prove sufficient for protecting healthy herds under such circumstances, particularly if the disease on the neighboring farm is stamped out in a short time and the premises are cleaned and disinfected properly. As a general proposition, however, it appears to be better to use the simultaneous inoculation for protecting healthy herds, provided this treatment can be given by a competent veterinarian or by a layman who is well trained and thoroughly familiar with the work. After immunizing healthy herds in this way they should be handled in very much the same way as infected herds for at least two weeks after treatment. In case the disease appears in a herd after treatment, the hogs should be promptly treated again with serum alone, or, if the entire herd is not retreated, at least those animals showing high temperatures or visible symptoms of the disease should receive another injection of serum.

Diseased herds.—In the field experiments conducted by the Bureau of Animal Industry during 1913, 1914, and 1915, it was the practice in some of the counties to use the serum-alone treatment exclusively, while in others all the apparently healthy hogs in diseased herds received the simultaneous inoculation, except that those showing temperatures above 104° F. received the serum alone. So far as the results of treatment are concerned, the losses from cholera were practically the same in the two sets of counties. However, in those counties where serum alone was used on all hogs, in diseased herds there was more or less recurrence of disease among the treated hogs. In other words, the healthy hogs in the diseased herds were protected

for some weeks but later lost their immunity, and the infection being still on the farm they then contracted cholera.

In the counties where the simultaneous inoculation was used on all apparently healthy hogs in infected herds, there were comparatively few cases of recurrence of disease, and where there were any recurrences they were among hogs which received the serum alone. In other words, some hogs supposed to be infected when treated and which, therefore, received serum alone, were probably not actually sick of cholera. They were protected for the time being, but later lost their immunity and contracted cholera from the infection which remained on the premises. In those herds where the sick hogs received serum alone and the apparently healthy hogs received the simultaneous inoculation, perhaps the results would have been still better, so far as recurrence of disease is concerned, if hogs showing temperatures above 104° F. had also been given the simultaneous inoculation.

When it is considered that the hog lots and buildings on a farm where cholera exists are already infected with the germs of the disease and that they may remain so for a long time after treatment, it seems that there is much to be said in favor of giving the simultaneous inoculation to all apparently healthy hogs, and also to those with temperatures, due to cholera, as high as 104° F., and the serum alone to the remainder, remembering, of course, that the destruction of severely sick hogs usually is advisable because the serum treatment can not be relied upon to cure many such cases.

EFFECT OF TREATMENT ON PREGNANT SOWS.

The question frequently is raised as to the advisability of administering serum and virus, or even serum alone, to pregnant sows. Decision in this respect probably should be governed somewhat by the condition of the herd. If infection has already appeared, it is generally conceded that without treatment the loss will be from 80 to 85 per cent of the entire herd and that pregnant sows will likely abort, while sows that live through the disease will not breed until they have recovered fully. Therefore there can be no question as to the advisability of treating sows in infected herds, regardless of the stage of pregnancy. Even though there can be no hope of saving the litter, there is a possibility of saving the sows and of enabling them to recover more rapidly and in better condition than if they were not treated. Except in cases of emergency it is considered best to avoid simultaneous inoculation of sows that are very near farrowing time.

The method of treatment is a matter of choice, as the results, so far as abortion is concerned, are practically the same. Statistics on the subject are compiled in the following table:

TABLE 4.—*Observations following treatment of pregnant sows in infected and in healthy exposed herds.*

Method of treatment.	Sows treated.	Sows aborted.	
	Number.	Number.	Per cent.
Infected herds:			
Serum alone.....	3,235	261	8.0
Simultaneous.....	1,357	98	7.2
Healthy exposed herds:			
Serum alone.....	126	2	1.5
Simultaneous.....	38		

EFFECT OF SIMULTANEOUS INOCULATION ON FERTILITY.

In connection with the field experiments previously referred to, 2,362 healthy brood sows in 181 herds received the simultaneous inoculation, and 95 per cent of them produced pigs the following year. During the same time observations were made of 1,840 healthy sows on 148 farms that were not treated, and it was found that 94 per cent of these produced pigs the following year. (See Table 5.) From these observations it is fair to conclude that the simultaneous method when properly applied to healthy brood sows does not produce sterility. The very fact that hyperimmune sows—that is, sows that are used for serum production and have received enormous doses of hog-cholera virus—generally farrow normal litters confirms these observations. (Figs. 10 and 11.)

TABLE 5.—*Summary of investigations as to effects of simultaneous inoculation on fertility of brood sows.*

Healthy brood sows.	Herds.	Sows.	Produced pigs following year.
	Number.	Number.	Per cent.
Treated with serum and virus.....	181	2,362	95.0
Not treated.....	148	1,840	94.4

TREATMENT OF YOUNG PIGS.

Pigs may be treated with serum alone or with the simultaneous inoculation, regardless of age. If young pigs receive both serum and virus, the immunity, as a rule, is lasting, and only an exceptional herd or individual will then contract cholera. It is known that pigs from sows which passed through the disease before being bred rarely contract hog cholera during the suckling period, but after that time they are likely to become susceptible. Therefore if cholera should appear on the premises, such pigs should be treated in the same way as the remainder of the herd.

The opinion that pigs weighing less than 60 to 75 pounds can not be immunized successfully by the simultaneous method has become more or less current in some sections of the country. The best available information indicates that such a belief is not true. If ample serum is administered with the virus, these small shoters can be treated by the simultaneous inoculation with safety, and certainly

the great majority of them will derive a lasting immunity from the treatment.

In a series of recent experiments conducted by specialists of the United States Department of Agriculture 171 pigs were inoculated when from 1 to 6 weeks old and were exposed to hog cholera at various times ranging from five months to nine months and twenty-six days later. Pigs that were approximately 1 week old received 10 cubic centimeters of antihog-cholera serum and one-half cubic centimeter of virus. Pigs that were 3 weeks old or more received from 15 to 20 cubic centimeters of serum and from one-half to three-fourths cubic centimeter of virus. Immunity was tested by injecting 5 cubic centimeters of virus into the animals when they had attained weights exceeding in many cases 200 pounds. None of the hogs contracted cholera. There was no apparent ill effect from the simul-

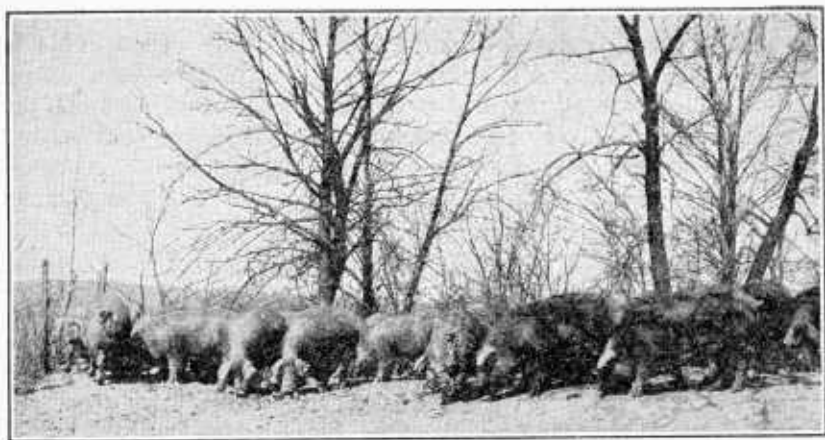


FIG. 10.—Portion of a herd of brood sows immunized by simultaneous inoculation. Figure 11 shows some of these sows with their litters the following spring.

taneous inoculation in any of the pigs, and there was no difference in the immunity of pigs from immune and nonimmune sows.

RESTOCKING AFTER AN OUTBREAK OF HOG CHOLERA.

In some instances the infection of hog cholera disappears from premises within a few weeks, while in other cases it remains for months. The infection is more likely to be eliminated quickly in summer than in winter. This is probably due to putrefaction and fermentation of infected material, as experiments have shown that the virus of hog cholera is usually destroyed by those processes. In the cold months of winter, putrefaction and fermentation do not take place, and infection persists for a longer time. No statement can yet be made of the exact time required for the elimination of infection on farms through natural agencies.

Sick hogs are a constant menace to nonimmune hogs; therefore susceptible hogs should not be placed on a farm so long as any sick

hogs remain on the premises, nor should they be brought on a farm where infection has existed until after the premises have been cleaned and disinfected. All old troughs, rubbish, litter, and other material that may be contaminated should be burned. As a general rule, the introduction of susceptible hogs on previously infected farms can not be regarded as safe at any season within less than three months after the last sick hogs have been removed unless the premises have been effectually cleaned and disinfected. It seems advisable, as a means of precaution, to immunize new litters farrowed on the premises, and also new stock brought on the farm within 90 days after all the sick hogs have recovered, and where possible new runways and feed lots should be provided.

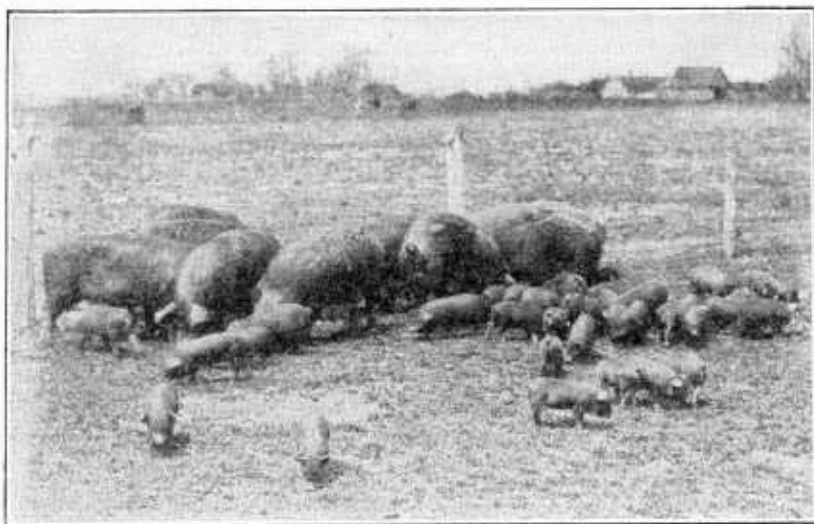


FIG. 11.—Immunized sows with their litters.

DRUG REMEDIES.

Up to the present time no drug or combination of drugs is known that can be regarded as a preventive or cure for hog cholera in a true sense of the words. From time to time preparations appear on the market composed of drugs and chemicals which are advertised to protect hogs against cholera or to cure hogs affected with the disease. Many of these so-called cures have been tested by Federal and State institutions and they have been found to be worthless as preventives or cures for hog cholera. Farmers therefore are warned against investing their money and placing their faith in hog-cholera medicines. "Antihog-cholera serum," prepared according to the methods originally worked out by the Bureau of Animal Industry, is the only agent known that can be regarded as a reliable preventive.

There are many so-called "tonics" advertised to do wonders for hogs, and some of them may have merits as condition powders. None, however, are of any value as a cure or preventive for hog cholera. The following formula has been used by farmers for a number of years and is probably as good as any other for a condition powder, but it will not serve to cure or prevent cholera:

	Pounds.
Wood charcoal	1
Sulphur	1
Sodium chlorid.....	2
Sodium bicarbonate	2
Sodium hyposulphite	2
Sodium sulphate	1
Antimony sulphid (black)	1

These ingredients should be mixed thoroughly and given with the feed in the proportion of a large tablespoonful to each 200 pounds' weight of hogs not oftener than once a day. Salt poisoning is sometimes produced by mixing overdoses of salt with the feed. Salt should be placed separately where the animals can help themselves at will.

CONCLUSION.

The end in view in combating hog cholera is the ultimate elimination of the disease, though at present it seems wiser to consider control rather than eradication.

Experiments of the Bureau of Animal Industry have demonstrated the possibility of greatly reducing the losses from hog cholera wherever farmers are willing to cooperate and take steps to prevent the spread of infection and secure the proper treatment of their herds.

Permanent reduction in losses from cholera can be expected only when farmers organize in a determined effort consisting principally of self-imposed quarantine, the continuous employment of sanitary measures, and the early use of the serum treatment, should the herd become infected or dangerously exposed.

It is important that competent veterinarians or trained laymen be employed to administer the treatment and that cooperation and support be given to any movement by State and Federal authorities for the eradication of hog cholera. If, however, farmers will not unite in this way, the complete extirpation of the disease can not be expected.

The United States Department of Agriculture does not prepare antihog-cholera serum for sale or distribution. For information as to where serum may be obtained and the help that may be had in combating hog cholera, write to the Bureau of Animal Industry, United States Department of Agriculture, Washington, D. C., or the State veterinarian, livestock sanitary board, or State agricultural college in the State where you reside.

BRIEF FACTS ABOUT HOG CHOLERA.

TO AVOID HOG CHOLERA.

LOCATE hog lots and pastures away from streams and public highways, and do not allow hogs to run on free range or highways, nor to have access to canals or irrigation ditches.

Do not visit a neighbor's farm nor allow him to visit yours if there is hog cholera on either place.

Do not drive into hog lots after driving on public highways.

Do not use hog lots for yarding wagons and farm implements.

Do not place newly purchased stock, stock procured or borrowed for breeding purposes, or stock exhibited at fairs immediately with your herd. Keep such stock quarantined in separate pens for at least two weeks, and use care in feeding and attending stock to prevent carrying infection from these to other pens.

Burn to ashes or cover with quicklime and bury under 4 feet of earth all dead animals and the viscera removed from animals at butchering time, because they attract buzzards, dogs, etc., which may carry hog-cholera infection.

If hog cholera appears in the neighborhood, confine your dog and encourage your neighbor to do the same.

TO COMBAT HOG CHOLERA WHEN IT APPEARS.

Have all hogs treated immediately with antihog-cholera serum as described in this bulletin, after which they should be kept on a light diet for a short time. An abundance of pure drinking water should be supplied, and the treated hogs should be kept in clean, sanitary quarters.

To obtain the best results the treatment must be administered as soon as the disease can be detected in the herd. Be sure that the temperature of all hogs is taken. A temperature above 104° F. in ordinary weather and when the animal is not excited indicates disease and the necessity for an increased dose of serum.

TO RID PREMISES OF INFECTION.

Remove the manure from the infected pens and yards and spread or place it in piles where it is not accessible to swine.

Burn all litter, rubbish, and old hog troughs. Keep hogs away from old straw stacks.

After the premises are thoroughly cleaned, spray walls, floors, and other surfaces, including remaining hog troughs, with a recognized disinfectant. Where hog houses are small, turn them over, exposing the interior to sunlight.

Wallow holes and cesspools should be filled in, drained, or fenced off.

All runs underneath buildings should be cleaned and disinfected and then boarded up to keep hogs out.

Destroy hogs that do not fully recover, as they may be carriers of cholera infection.

IMPORTANT FACTS ABOUT THE SERUM TREATMENT

THE SIMULTANEOUS (VIRUS-SERUM) INOCULATION GIVES HOGS A LASTING IMMUNITY AGAINST CHOLERA.

THIS TREATMENT CONSISTS IN INOCULATING THE HOG WITH A SMALL AMOUNT OF THE VIRUS AND AT THE SAME TIME INJECTING A PROPER DOSE OF ANTI-HOG-CHOLERA SERUM.

GOOD SERUM AND VIRUS PROPERLY ADMINISTERED ARE NECESSARY FOR SUCCESS.

THE TREATMENT SHOULD BE GIVEN BY COMPETENT VETERINARIANS OR BY PERSONS WITH SPECIAL TRAINING AND EXPERIENCE.

SERUM-ALONE TREATMENT GIVES TEMPORARY PROTECTION, LASTING FROM TWO TO SIX WEEKS.